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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/960,398	09/24/2001	Masaki Kurasawa	011254	5650
38834	7590	02/02/2004	EXAMINER	
WESTERMAN, HATTORI, DANIELS & ADRIAN, LLP			LE, THAO X	
1250 CONNECTICUT AVENUE, NW				
SUITE 700			ART UNIT	PAPER NUMBER
WASHINGTON, DC 20036			2814	

DATE MAILED: 02/02/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	<b>Application No.</b> 09/960,398	<b>Applicant(s)</b> KURASAWA ET AL.	
	<b>Examiner</b> Thao X Le	<b>Art Unit</b> 2814	

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 02 December 2003.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-14 and 29-32 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-14, 30-31 is/are rejected.
- 7) ☒ Claim(s) 29 and 32 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
     Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
     Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. §§ 119 and 120**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
     a) ☐ All    b) ☐ Some \*    c) ☐ None of:  
         1. ☐ Certified copies of the priority documents have been received.  
         2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
         3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
     \* See the attached detailed Office action for a list of the certified copies not received.
- 13) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.  
     a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)                             | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____  |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)         | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ | 6) <input type="checkbox"/> Other: _____                                    |

## DETAILED ACTION

### *Claim Rejections - 35 USC § 103*

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

2. Claims 1-5, 7, 9, 11, 30-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 5619393 to Summerfelt et al. in view of US 6294860 to Shimada et al.

Regarding to claim 1, Summerfelt discloses a capacitor in fig. 19 comprising: a buffer structure 34 formed on a substrate 30, a lower electrode 36 formed on the buffer structure 34, a capacitor dielectric film 38 formed on the lower electrode 36, and formed of a perovskite ferroelectric material having a smaller thermal expansion coefficient (CTE) than that of the buffer structure, an upper electrode 40 formed on the capacitor dielectric film, the buffer structure having a height larger than a width thereof.

But Summerfelt does not expressly disclose the perovskite ferroelectric material having a crystal oriented substantially perpendicular to a surface of the lower electrode

However, Shimada reference discloses a capacitor structure in fig. 2 comprises a substrate 10, a buffer layer 11/11A, a lower electrode 12, a perovskite ferroelectric (PZT) material having a crystal oriented substantially perpendicular to a surface of the lower electrode, see abstract. At the time the invention was made; it would have been obvious to one of ordinary skill in the art to use the PZT crystal orientation teaching of Shimada in place of Summerfelt's device, because it would have provided a high piezoelectric strain constant and a good adhesion with a lower electrode which can be produced without being cracked as taught by Shimada, see abstract.

With respect to the perovskite ferroelectric material having a smaller thermal expansion coefficient (CTE) than that of the buffer structure, it is known that Palladium has the CTE about  $13 \times 10^{-6}/\text{C}^{\circ}$ , while PZT has the CTE about  $1.8 \times 10^{-6}/\text{C}^{\circ}$ .

With respect to suppress stress applied to the capacitor dielectric film caused by a CTE difference between the substrate and the capacitor dielectric. This function is obvious in the structure because the when the structure recited in the reference is substantially identical to that of the claims, claimed properties or functions are presumed to be either anticipation or obviousness. *In re Best*, 195 USPQ 430, 433 (CCPA 1977).

Regarding to claim 2, Summerfelt discloses the silicon substrate 30 and PZT capacitor dielectric 38; therefore the CTE of PZT would be larger than that of the silicon substrate.

Regarding to claim 3, as discussed in the claims 1 and 2 above; Summerfelt and Shimada disclose all the limitations in claim 3.

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Regarding to claim 4, Summerfelt discloses the platinum (Pt) lower electrode 36 and PZT capacitor dielectric 38; therefore the CTE of Pt metal would be larger than that of the PZT.

Regarding to claims 5, 7, 9 and 11, Summerfelt does not disclose the capacitor wherein the capacitor dielectric film 38 has (001) oriented tetragonal and (111) oriented rhombohedral crystal structure.

However, Shimada reference discloses the capacitor wherein the capacitor dielectric film 14 has (001) oriented tetragonal and (111) oriented rhombohedral crystal structure, column 4 line 45-52. At the time the invention was made, it would have been obvious to one of ordinary skill in the art to use the PZT crystal orientation teaching of Shimada in place of Summerfelt's device, because it would have provided a high piezoelectric strain constant and a good adhesion with a lower electrode which can be produced without being cracked as taught by Shimada, see abstract.

Regarding claims 30-31, the process limitations "capacitor dielectric film is formed by CVD method" in claims 30-31, do not carry weight in a claim drawn to structure. In re Thorpe, 277 USPQ 964 (Fed. Cir. 1985).

3. Claims 1-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 5619393 to Summerfelt et al. in view of JP 02000286396 to Hiyama et al.

Regarding to claim 1, Summerfelt discloses a capacitor in fig. 19 comprising: a buffer structure 34 formed on a substrate 30, a lower electrode 36 formed on the buffer structure 34, a capacitor dielectric film 38 formed on the lower electrode 36, and formed of a perovskite ferroelectric material having a smaller thermal expansion coefficient (CTE) than that of the

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buffer structure, an upper electrode 40 formed on the capacitor dielectric film, the buffer structure having a height larger than a width thereof.

But Summerfelt does not expressly disclose the perovskite ferroelectric material having a crystal oriented substantially perpendicular to a surface of the lower electrode

However, Hiyama reference discloses a capacitor comprising: a buffer structure 3 formed on a substrate 1, a lower electrode 4 formed on the buffer structure 3, a capacitor dielectric film 5 formed on the lower electrode 4, and formed of a perovskite ferroelectric material (PZT), having a crystal oriented substantially perpendicular to a surface of the lower electrode 4. At the time the invention was made; it would have been obvious to one of ordinary skill in the art to use the PZT crystal orientation teaching of Hiyama in place of Summerfelt's device, because it would have provided a FeRAM can be driven by the low battery as taught by Hiyama, see attachment [001].

With respect to the perovskite ferroelectric material having a smaller thermal expansion coefficient (CTE) than that of the buffer structure, it is known that Palladium has the CTE about  $13 \times 10^{-6}/\text{C}^{\circ}$ , while PZT has the CTE about  $1.8 \times 10^{-6}/\text{C}^{\circ}$ .

With respect to suppress stress applied to the capacitor dielectric film caused by a CTE difference between the substrate and the capacitor dielectric. This function is obvious in the structure because the when the structure recited in the reference is substantially identical to that of the claims, claimed properties or functions are presumed to be either anticipation or obviousness. *In re Best*, 195 USPQ 430, 433 (CCPA 1977).

Regarding to claim 2, Summerfelt discloses the silicon substrate 30 and PZT capacitor dielectric 38; therefore the CTE of PZT would be larger than that of the silicon substrate.

Regarding to claim 3, as discussed in the claims 1 and 2 above; Summerfelt and Hiyama disclose all the limitations in claim 3.

Regarding to claim 4, Summerfelt discloses the platinum (Pt) lower electrode 36 and PZT capacitor dielectric 38; therefore the CTE of Pt metal would be larger than that of the PZT.

Regarding to claims 5-12, Summerfelt does not disclose the capacitor wherein the capacitor dielectric film 38 has (001) oriented tetragonal and (111) oriented rhombohedral crystal structure and the lower electrode 4 has (100) and (111) cubic oriented crystal structure.

However, Hiyama reference discloses the capacitor wherein the capacitor dielectric film 14 has (001) oriented tetragonal and (111) oriented rhombohedral crystal structure and the lower electrode 4 has (100) and (111) cubic oriented crystal structure, see abstract. At the time the invention was made; it would have been obvious to one of ordinary skill in the art to use the PZT crystal orientation teaching of Hiyama in place of Summerfelt's device, because it would have provided a FeRAM can be driven by the low battery as taught by Hiyama, see attachment [001].

4. Claims 13-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 5619393 to Summerfelt et al. in view of JP 02000286396 to Hiyama et al and US Pub 2002/0063274 to Kanaya et al.

Regarding to claims 13-14, as discussed in the above claims 1 and 3, Summerfelt and Hiyama disclose all the limitation recited in claim 13, except a semiconductor device comprises a memory cell transistor formed on a semiconductor substrate, and including a gate electrode, and source/drain diffused layers formed in the semiconductor substrate respectively on both sides

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of the gate electrode, an insulating film covering the semiconductor substrate with the memory cell transistor formed on, a titanium buffer structure, formed on the insulation film.

However, Kanaya reference discloses Kanaya discloses a semiconductor device in fig. 4B comprising: a memory cell transistor 10 formed on a semiconductor substrate 1, and including a gate electrode 12, and source/drain diffused layers 13/14 formed in the semiconductor substrate respectively on both sides of the gate electrode, an insulating film 2a/2b covering the semiconductor substrate with the memory cell transistor formed on, a titanium buffer structure 3a and 32a, fig. 3f and fig. 8, formed on the insulation film. At the time the invention was made; it would have been obvious to one of ordinary skill in the art to combine the teaching of Kanaya with Summerfelt and Hiyama, because such FeRAM structure (transistor connection with capacitor) is conventional the art.

With respect to suppress stress applied to the capacitor dielectric film caused by a CTE difference between the substrate and the capacitor dielectric. This function is obvious in the structure because the when the structure recited in the reference is substantially identical to that of the claims, claimed properties or functions are presumed to be either anticipation or obviousness. *In re Best*, 195 USPQ 430, 433 (CCPA 1977).

#### ***Allowable Subject Matter***

5. Claims 29 and 32 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. The prior art of record neither anticipated nor render obvious



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all the limitations of the claims 29 and 32 including the buffer layer structure is formed of an insulating material.

### ***Response to Arguments***

6. Applicant's arguments filed on 12/02/03 have been fully considered but they are not persuasive. The Applicant argues that the prior art uses the sol-gel method to form the perovskite film, while the instant application uses CVD method to form the perovskite film. The claim language requires the perovskite film having crystal oriented substantially perpendicular to a surface of the lower electrode. The combination of prior art as discussed above would read on the claim language. Furthermore the process limitations do not carry weight in a claim drawn to structure. In re Thorpe, 277 USPQ 964 (Fed. Cir. 1985).

### ***Conclusion***

7. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event,

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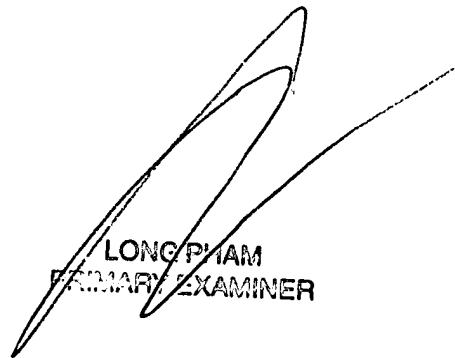
however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thao X Le whose telephone number is (571) 272-1708. The examiner can normally be reached on M-F from 8:00 AM - 4:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael M Fahmy can be reached on (571) 272 -1705. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

Thao X. Le  
28 Jan. 2004



LONG PHAM  
PRIMARY EXAMINER